

## SECTION C Descriptions and Specifications

### C - STATEMENT OF WORK

Commercial Depot Level Overhaul of US Navy LM2500 Single Shank (SST) Gas Generator assembly and concurrent component and accessories.

#### C.1 Scope

This specification identifies the requirements for commercial depot level overhaul of one (1) US Navy single shank LM2500 gas generator, national stock number (NSN) 2S 2835-01-237-1153. Offers will be solicited from established commercial overhaul depots that are technically capable in commercial overhaul of the US Navy LM2500 SST gas generator.

#### C.2 Applicable Documents

##### C.2.1 General

While every effort has been made to ensure the completeness of this list, document users are cautioned that they shall meet all specified requirements cited in Sections C.3 and C.4 of this specification, in addition to the specifications listed in the documents listed in Section C.2.2.

##### C.2.2 Government Documents

US Navy LM2500 Technical Manuals:

Organizational Level:

- S9234-AD-MMO-070/LM2500 latest revision
- S9234-AD-MMO-080/LM2500 latest revision
- S9234-AD-MMO-090/LM2500 latest revision

Depot Level Maintenance:

- S9234-AB-MMD-010/LM2500 latest revision
- S9234-AB-MMD-020/LM2500 latest revision
- S9234-AB-MMD-030/LM2500 latest revision
- S9234-AB-MMD-040/LM2500 latest revision
- S9234-AB-MMD-050/LM2500 latest revision
- S9234-AB-MMD-060/LM2500 latest revision

If requested, the US Navy LM2500 technical manuals will be provided after contract award to the successful offeror. Application for copies of US Navy LM2500 technical manuals shall be addressed to Naval Surface Warfare Center (NSWC) Code 9333. The Contractor must request permission from NSWC Code 9333 to reproduce the manuals. Any US Navy manuals issued, and all copies made, and all printouts generated will remain the property of the US Navy.

##### C.2.3 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the US Navy LM2500 technical manuals listed in Section C.2.2 of this document take precedence. These manuals are as follows: Depot Level Maintenance S9234-AB-MMD-010/LM2500 through S9234-AB-MMD-060/LM2500 latest revision and Organizational Level Maintenance S9234-AD-MMO-070/LM2500 through S9234-AD-MMO-090/LM2500 latest revision.

### C.3 Requirements

### **C.3.1 General**

The contractor shall have prior experience with the overhaul of the General Electric LM2500 SST gas generator for industrial or marine customers.

The contractor shall furnish services in accordance with any written technical instructions. No verbal instructions will be accepted to the specifications set forth herein.

The contractor shall overhaul, modify, incorporate mandatory updates, maintain standard configuration integrity, assemble, test, preserve, package, document, mark and prepare for shipment the LM2500 SST gas generator in accordance with this specification.

All overhaul work performed under this specification shall be in accordance with the current US Navy LM2500 depot level technical manuals, S9234-AB-MMD-010 through S9234-AB-MMD-060 latest revision, as applicable for the articles under overhaul. Any and all deviations from these technical manuals must be approved, in writing, by the cognizant technical representative at NSWC prior to implementation.

All overhaul work performed under this specification shall be for articles to be modified to standard configuration, overhauled and delivered Ready For Issue (RFI) to the fleet. All parts shall be cleaned in accordance with procedures outlined in US Navy LM2500 depot level technical manual S9234-AB-MMD-010/LM2500 Chapter 3 or US Navy approved equivalent standard commercial procedures. The overhauled LM2500 SST gas generator shall be free of all corrosion when delivered to the US Navy.

If, after contract award, the contractor proposes to use repair procedures (which are not specifically allowable under the current Statement of Work) to complete the engine overhaul, the contractor must request approval from NSWC Code 9333 to use any alternate repair procedures. If NSWC Code 9333 approves any alternate repair procedures, the contract price shall be negotiated downward to reflect the cost savings obtained from the alternate repair process(es).

In addition to NSN and part number (PN) markings contained herein, overhauled units shall be marked, in accordance with standard commercial practice, with the delivery order number and date of overhaul.

### **C.3.2 Tooling**

The contractor shall possess all supplies and materials necessary to accomplish the overhaul of US Navy LM2500 SST gas generator assembly, including accessories. At the time of proposal submission, all contractors shall possess a minimum of 90% of the total number, and 95% of the total dollar value, of all required tooling and machinery necessary to perform an overhaul of an LM2500 SST gas generator. Subcontractor tooling and the amount of subcontractor tooling will be utilized to determine whether a contractor possesses the minimum of 90% of the total number, and 95% of the total dollar value, of all required tooling and machinery necessary to perform an overhaul of an LM2500 SST gas generator. The US Navy shall not provide nor be responsible for any special support equipment, tooling, or machinery used for the overhaul of US Navy LM2500 SST gas generator. A list of Special Support Equipment and tooling required to perform an overhaul of an LM2500 SST gas generator and its accessories is contained in US Navy depot level technical manual S9234-AB-MMD-010/LM2500 Chapter 2. This list outlines the minimum required equipment needed to perform an overhaul of an LM2500 SST gas generator. Offerors may propose to use LM2500 SST gas generator special support equipment, tooling, and associated machinery in excess of what is required in US Navy technical manual S9234-AB-MMD-010/LM2500 Chapter 2, that enhances the offerors ability to perform an LM2500 overhaul.

### **C.3.3 Test Cell**

The contractor shall, at a minimum, have an operational test cell and overhaul facility. The contractor's gas turbine test cell facility shall, at a minimum, be in the thirty thousand (30,000) pound thrust class. The contractor shall test for both proper function and performance throughout the entire range of operation from start through the full power

rating. The contractor shall be fully capable of performing the following: functional testing of the gas generator including vibration, starting, restarting, acceleration, and HP Recoup. Expected performance guidelines are outlined in Section C.4.1. Procedures, testing points, instrumentation, and the instrumentation ranges and tolerances required to measure function and performance are specified in the US Navy LM2500 depot level technical manual S9234-AB-MMD-030/LM2500 latest revision, Section 13.2.

In the event of a failure in the testing, additional tests (penalty tests) shall be performed to ensure that the mechanical deficiency was corrected by the maintenance performed, however, the complete testing of the gas generator shall be performed in conjunction to these additional tests.

All accessories shall be tested individually in accordance with the testing procedures outlined in the most recent version of the US Navy LM2500 depot level technical manuals. Copies of the accessories test reports shall be provided to NSWC Code 9333. The contractor's ability to demonstrate the compilation of gas generator rebuild information in a gas generator overhaul report shall be evaluated in accordance with Section L of this solicitation.

The fuel used during testing of the gas generator shall be either JP-5, Jet A1, JP-8, Jet A or marine diesel oil. The gas generator shall be the standard US Navy configuration once the overhaul is completed and the gas generator is shipped back to the US Navy.

The test cell shall, at a minimum, have the instrumentation requirements to meet or exceed the associated ranges and tolerances specified in Table 13-1.2 of the US Navy depot level technical manual S9234-AB-MMD-030/LM2500 latest revision.

The contractor shall provide as part of their testing proposal documentation to state if the US Navy LM2500 gas generator will be tested with slave accessories.

### **C.3.4 Material**

The contractor shall supply and only use US Navy approved parts in the overhaul of US Navy LM2500 SST gas generator. All approved parts for use in US Navy LM2500 SST gas generator are listed in the US Navy LM2500 Illustrated Parts Breakdown S9234-AD-MMO-070/LM2500 through S9234-AD-MMO-090/LM2500 latest revision. The use of aftermarket parts is not permitted.

All US Navy material shall be stored indoors in a separate secured area. The contractor shall be responsible for the security of any US Navy assets while the assets are at the contractor's facility until the time that the asset(s) is (are) delivered to a US Navy facility.

#### **C.3.4.1 US Navy Furnished Gas Turbine Upgrade Kits**

The US Navy will provide the contractor with selected US Navy LM2500 gas turbine upgrade kits. These kits will be provided at no expense to the contractor. All available US Navy LM2500 gas turbine upgrade kits are listed in Tables 1 and 2.

The upgrade kits listed in Table 1 are required as needed based on the teardown and inspection of the engine. The upgrade kits listed in Table 2 are mandatory to be installed.

| Kit Number      | Description                                       | GTC # |
|-----------------|---|-------|
| 9012LKA117496TU | Replacement of Fuel Pump Strainer Element         | 12    |
| 9013LKA117701TU | HPT Stg 2 Nozzle Assy & Turbine Midframe Assy     | 13    |
| 9017LKA117997TU | CDP Rotating Air Seal                             | 17    |
| 9019LKA118189TU | Compressor Rotor Assembly                         | 19    |
| 9019LKA218190TU | Compressor Rotor Assembly Kit 2                   | 19    |
| 9021LKA718201TU | High Pressure Turbine Rotor Kit                   | 21    |
| 9024LKA119233TU | Electrical Connector Sealing Improvement          | 24    |
| 9026LKA222582TU | Compressor Stg 3-6 VSV Bushing Improvement        | 26    |
| 9028LKA120165TU | No. 5 & 6 Bearing Heat Shields & Thermal Blankets | 28    |
| 9029LKA120257TU | HPT Rotor Hook Bolt                               | 29    |
| 9031LKA120259TU | AFT Thermocouple Lead                             | 31    |
| 9033LKA120426TU | Internal Components-Main Fuel                     | 33    |
| 9034LKA120432TU | Cooling & Vent Seal Tube Brackets                 | 34    |
| 9045LKA121637TU | Main Fuel Pump, Plug Seating                      | 45    |
| 9051LKA121788TU | Deletion Of C- And D- Sump Lube System Check      | 51    |
| 9052LKA121789TU | Redesign Of The PT5.4 Pressure Sensing System     | 52    |
| 9053LKA121790TU | Replacement Of A- And B- Sumps Ejector Nozzle     | 53    |
| 9044LKA121636TU | Major Update to MFC                               | 54    |
| 9055LKA122651TU | Starter Upgrade New Shaft Seal                    | 55    |
| 9056LKA123082TU | Compressor Rotor Stability Improvement            | 56    |
| 9057LKA123363TU | Deletion Of Pilot Pressure Relief Valve           | 57    |
| 9064LKA124017TU | Improved LPT Interstage Seal Bolting              | 64    |
| 9066LKA124869TU | MFC Control Meter Vlv. / T2 Servo Sleeve          | 66    |
| 9091LKA129427TU | Elimination Of Aerodynamic Instability            | 91    |

**Table 1: LM2500 Gas Turbine Upgrade Kits**

| GTC/GTB/AYC | Issue Date                                    | Subject  | Kits/Part Number                   |
|-------------|---|--|------------------------------------|
| GTC 75      | 6/13/2002                                     | Installation of Redesigned VSV Stage 5 and 6 Vane Arms                                     | No Kit Available                   |
| GTC 77R1    | 2/10/92 (Issued)<br>7/15/96 (Latest Revision) | Accelerometer Vibration Sensing System Mod on DD-963, DD-993, CG-47 and DDG-51 Class Ships | 9077LKA228126TU                    |
| GTC 78      | 6/13/2002                                     | Compressor Variable Stator Improvements  | No Kit Available                   |
| GTC 79R2    | 1/2/96 (Issued)<br>7/15/96 (Latest Revision)  | Addition of a Vibration Dampening Bracket and Clamp on "C" Sump Lube Supply Line           | 9079LKA125702TU<br>9079LKA225703TU |
| GTC 83R1    | 10/18/2001                                    | Installation of New Lube and Scavenge Pump   | 9083LKA127123TU<br>9083LKA227124TU |
| GTC 84R2    | 7/27/92 - 3/23/94                             | Provide Improved Fuel Manifold That Incorporates Flexible Hoses                            | 9084LKA127463TU                    |
| GTC 89      | 8/10/1994                                     | Coast Metal 64 Hardcoat TMF For Wear Protection  | N/A                                |
| GTC 95      | 5/7/2001                                      | Improved LM2500 PLA  | 9095LKA129853TU                    |
| GTC 96      | 8/1/2003                                      | LM2500 Flexible T5.4 Thermocouple Harness  | GTC96K1R0GTM                       |
| GTB 24R1    | 4/10/2000                                     | Inspection/Installation of TMF Anti-Rotation Pins  | 135042                             |
| AYC 39R1    | 10/23/1997                                    | Improved Drain System for the Fuel Shut-Off Valves   | 9039LKA128217TW                    |
| AYC 42      | 5/7/2001                                      | PLA Connector/Cable Improvement  | 9042LKA129850TW                    |

**Table 2: Mandatory Gas Turbine Technical Directive Bulletin/Changes to Upgrade Kits**

### **C.3.5 LM2500 SST Gas Generator Minimum Work Scope**

The contractor shall perform a complete teardown and inspection of the US Navy LM2500 SST gas generator including accessories. The contractor shall also visually inspect gas generator external components and visible flanges, control and accessories piping, electrical leads, clamps, brackets, nuts, bolts, etc. for damage, wear, deterioration, looseness, proper configuration, etc. All US Navy LM2500 SST gas generator components shall be inspected in accordance with inspection criteria outlined in the US Navy LM2500 depot level technical manuals.

All teardown and inspection results and contractor overhaul recommendations shall be forwarded to NSWC Code 9333.

After completion of teardown and inspection the contractor shall hold a work scope meeting with NSWC Code 9333. This meeting will decide the amount of work that will be performed to return this asset to a ready for issue (RFI) status. During the work scope meeting, any unforeseen work which is over and above the minimum repair requirements of this specification will be discussed. Unforeseen work will be addressed in accordance with the provision set forth in Section H. The US Navy reserves the right to furnish replacement parts for unforeseen repairs. The US Navy also requires a proposed cost estimate for unforeseen repairs at the work scope meeting. All Over and Above repairs shall be in accordance with the procedures outlined in the US Navy LM2500 depot level technical manuals.

The US Navy LM2500 SST gas generator shall have the overhaul work identified Sections C.3.5.1 through C.3.6 of this specification performed during the overhaul of the US Navy LM2500 SST gas generator.

#### **C.3.5.1 Compressor Rotor and Stator**

Disassemble, inspect, clean, and process as described below and per procedures outlined in the US Navy LM2500 depot level technical manuals.

##### **COMPRESSOR ROTOR:**

- a. Steam clean compressor, disassemble, inspect and process.
- b. Replace Stage 1 blades. Install reworked blades with new mid-span carboloy pads (Gas Turbine Change (GTC) 23R1). Map all compressor rotor balance weights in accordance with depot level technical manual.

Per US Navy LM2500 depot level technical manual:

3 - 9 spool not to exceed 10 weights.

10<sup>th</sup> stage disc not to exceed 3 weights.

11 - 13 spool not to exceed 16 weights.

14 - 16 spool not to exceed 12 weights.

Complete compressor rotor not to exceed 24 total weights.

- c. Remove all blades and route for processing.
- d. Inspect for blade platform gap. If minimum gap is exceeded, install additional wide platform blades as required to reduce gap.

##### **COMPRESSOR STATOR:**

- a. Disassemble, clean and process.
- b. Inspect variable stator vane (VSV) shroud per paragraph 8-179/Table 8-63 of US Navy LM2500 depot level technical manual. If GTC 36 not incorporated previously, comply.

#### **C.3.5.2 Compressor Rotor Repair Deviation**

All serviceable stage 1 compressor blades shall be repaired and provided with a full 20 mils (+/- 1 mil) thickness carboloy wear pad. Braze shall encompass the pad 100%, there shall be no clearance between the pad and mid span shroud surface. The pad shall be masked during dovetail stripping to prevent damage to carboloy wear pad.

#### **C.3.5.3 Combustor**

Disassemble, inspect, clean, and process per procedures outlined in the US Navy LM2500 depot level technical manuals. Remove combustor and replace hastelloy dome with HS 188 dome PN 9016M57G06/G08 (retain the swirlers). The contractor is responsible for providing the replacement HS 188 dome. Inspect per paragraph 8-294 of US Navy LM2500 depot level technical manual.

#### **C.3.5.4 Combustor Repair Deviation**

All serviceable fuel nozzles require complete overhaul in accordance with US Navy LM2500 depot level technical manual. Flow and test only is not acceptable.

#### **C.3.5.5 High Pressure Turbine**

Disassemble, inspect, clean, and process per procedures outlined in the US Navy LM2500 depot level technical manual.

- a. Disassemble, inspect and process per paragraphs 8-372 through 8-377 of US Navy LM2500 depot level technical manual.
- b. Rework all nozzles.
- c. Rework all blades.
- d. Rework all shrouds.
- e. Comply with GTCs 13 and 29.
- f. Inspect the following:
  1. Forward rotating air seals.
  2. Coupling nut, including silver plating.
  3. Forward shaft.
  4. Stage 1 disk.
  5. Stage 1 blade retainer.
  6. Thermal shield.
  7. Stage 2 disk.
  8. Stage 2 blade retainer.
  9. Rear shaft.
- g. Remove aft shaft, pressure tube and inspect.
- h. Remove borescope plugs inspect in accordance with US Navy LM2500 depot level technical manual, including silver replating/apply antiseize.

#### **C.3.5.6 High Pressure Turbine Blade and Nozzle Coating Requirements**

The high pressure turbine (HPT) blades and nozzles shall be coated as follows:

- a. All serviceable Stage 1 and Stage 2 HPT blades shall be provided with Platinum Aluminide (PtAl) coating. Complete blade repair required, mini tip repairs are not acceptable.
- b. All serviceable Stage 1 and Stage 2 HPT nozzles shall be provided with PtAl coating.

#### **C.3.5.7 Frames, Bearings, Seals, and Gearbox**

Disassemble, inspect, clean, and process per procedures outlined in the US Navy LM2500 depot level technical manuals. In addition, the contractor shall perform the following:

- a. Remove, clean, inspect, and preserve all gas generator main bearings per paragraph 8.43 of US Navy LM2500 depot level technical manual.
- b. Inspect accessory gearbox mounting link and rod ends for spherical ball bearings wear, fretting, and looseness.
- c. Replace piston rings on 4R seal with PN 9693M18P04 (Kit No. 537L180G01) rings.
- d. Inspect compressor rear frame (CRF) internal hub and strut fillets for cracks.
- e. Inspect compressor front frame (CFF) for corrosion and missing paint. Also check mounting bushing and inner bushing for wear. Replace oil supply tube "O" Ring, PN J221P020 per Figure 9-28, item 3 in S9234-AB-MMD-030/LM2500.
- f. Inspect turbine mid frame (TMF) liner for cracks and distortion.

- g. Replace No. 5 and 6 bearing heat shields per GTC 28.
- h. Pressure test sumps (all frames).
- i. Replace compressor rear case (CRC) to CRF bolts with PN 9665M50P12.
- j. Install PN 9084M64 oil inlet tube on all TMF(s) processed. Remove and replace PN 9677M81 old style tubes.
- k. Inspect and test CRF oil tubes for cracks.
- l. Disassemble to allow for inlet and accessory gearbox bearing processing.
- m. Inspect and test speed sensor per paragraph 47.11 of US Navy LM2500 depot level technical manual.
- n. Remove borescope plugs, inspect, apply antiseize.
- o. Install inlet gearbox (IGB) nut, PN L16569P04 per Figure 51-41 of US Navy LM2500 organizational level technical manual.
- p. Replace bearing, compressor air seal, per Figure 8-8 of US Navy LM2500 organizational level technical manual, original Phenalic seals PN 9654M03G03 and 9654M03G06 with Teflon seal PN L44765G01.
- q. Replace stationary oil seal , per Figure 8-16 of US Navy LM2500 organizational level technical manual, original Phenalic seals PN 9654M23P03 and 9654M23P04 with Teflon seal PN L47033G02.
- r. Replace air/oil separator, per Figure 53-2 of US Navy LM2500 organizational level technical manual, original Phenalic seals PN 9634M44P02 and 9634M44P04 with Teflon seals PN 9634M44P06 or 9634M44P07.
- s. Dimensional inspect No. 4B stationary oil seal 9693M49P05 and re-identify per CID 60543.

Any conditions found that exceed the technical manual service limits require repair or replacement of component in accordance with the US Navy LM2500 depot level technical manuals.

#### **C.3.5.8 Gas Generator Controls and Accessories**

In addition to inspection and repair procedures outlined in the US Navy LM2500 depot level technical manuals, the contractor shall perform the following:

- a. Remove and inspect starter for foreign object damage. Comply with gas turbine changes to meet requirements of Section C.3.6.
- b. Remove main fuel control and bench test per paragraph 24.2.76 of US Navy LM2500 depot level technical manual. Comply with gas turbine changes to meet requirements of Section C.3.6.
- c. Remove fuel pump, inspect and clean (GTC 12) strainer element, modify for eductor plug unseating per GTC 45. Test per paragraph 26.14 of US Navy LM2500 depot level technical manual. Comply with gas turbine changes to meet requirements of Section C.3.6.
- d. Remove fuel nozzles, inspect and test the entire set per paragraph 31-12 of US Navy LM2500 depot level technical manual.
- e. Inspect, clean, test, or replace main fuel filter element per Chapter 27 of US Navy LM2500 depot level technical manual.
- f. Remove and bench test fuel shut-off valves per paragraph 29.13 of US Navy LM2500 depot level technical manual. Comply with Ancillary Equipment Change (AYC) 39.
- g. Remove and bench test compressor inlet temperature (CIT) sensor per paragraph 25.13 of US Navy LM2500 depot level technical manual. Comply with gas turbine changes to meet requirements of Section C.3.6.
- h. Remove, inspect and test all electrical cables for wear of braid and interface connectors for integrity, cleanliness and seals (GTC 24).
- i. Inspect and test VSV feedback cable per paragraph 47.6 of US Navy LM2500 depot level technical manual.
- j. Inspect and repair as required and test power level angle (PLA) actuator. Comply with GTC 95.
- k. Inspect and test vibration transducer per paragraph 47.19 of US Navy LM2500 depot level technical manual.
- l. Inspect PT 5.4 probes, pigtails, and manifold per paragraph 47.7 of US Navy LM2500 depot level technical manual.
- m. Inspect fuel manifold for end connector cracks. Comply with GTC 84R2 if not incorporated.

- n. Inspect and test overspeed transducer leads per paragraph 47.18 of US Navy LM2500 depot level technical manual.
- o. Lube and scavenge pump – perform bench test. Repair/replace if limits are not met per Chapter 33 of US Navy LM2500 depot level technical manual. Comply with GTC 83R1.
- p. Pressurizing valve – perform bench test. Repair/replace if limits are not met per paragraph 28.13 of US Navy LM2500 depot level technical manual.
- q. Fuel filter assembly – perform bench test. Repair/replace if limits are not met per paragraph 27.12 of US Navy LM2500 depot level technical manual.
- r. VSV actuator – perform bench test. Repair/replace if limits are not met per paragraph 32.13 of US Navy LM2500 depot level technical manual. Comply with GTC 78.
- s. Inspect and test resistance temperature detectors (RTD) per paragraph 47.10 of US Navy LM2500 depot level technical manual.
- t. Inspect and test spark igniter per paragraph 47-16 of US Navy LM2500 depot level technical manual.
- u. Inspect and test ignition exciter per Chapter 39 of US Navy LM2500 depot level technical manual.

Any conditions found that exceed the technical manual service limits require repair or replacement of component in accordance with the US Navy LM2500 depot level technical manuals.

### C.3.6 LM2500 SST Gas Generator Configuration

All US Navy LM2500 SST gas generator accessories shall be of the following configuration after overhaul:

|                            |            |
|----------------------------|------------|
| a. Main Fuel Control (MFC) | L16716P25  |
| b. Fuel Pump               | 9039M45P09 |
| c. Lube and Scavenge Pump  | L24407P07  |
| d. PLA Actuator            | L22263P07A |
| e. CIT Sensor              | L21225P02  |
| f. Starter                 | L34085P08  |

PLA actuators that are of a higher configuration (e.g. a L22263P09 PLA is higher configuration than that of a L22263P07A PLA) shall not be reconfigured to the configuration listed above. The higher configuration accessories shall be repaired in their current configuration. L22263P07A represents the minimum repair requirements. This applies to the PLA only.

All US Navy LM2500 SST gas generator shall have the mandatory Gas Turbine Technical Directives (TDs), GTBs/GTCs/AYCs, listed in Table 2 incorporated during the overhaul. NSWC Code 9333 will provide the upgrade kits to the contractor to incorporate these Technical Directives at no cost to the contractor, for GTCs listed in Table 2 with the exception being GTCs 75, 78 and 89 for which the contractor will have to provide. To view/download individual Technical Directives, the contractor may visit the US Navy Marine Gas Turbine website at [www.navygasturbines.org](http://www.navygasturbines.org).

In conjunction with GTC 89, GTB 24R1 shall also be incorporated. GTB 24R1 installs anti-rotation pins in the TMF to prevent a clocked liner from contacting and severing the gas generator thermocouples. The US Navy will supply the anti-rotation pins to the contractor at no cost.

US Navy gas turbine kits shall only be requested if the kit is required for the overhaul. These kits shall be used for upgrading of the gas generator and accessories only. If the gas generator being overhauled previously had one of the GTCs listed above incorporated, the kit for that GTC shall not be requested, except when kit incorporation is necessary to maintain standard configuration. Determination of what kits are needed is the responsibility of the contractor. The tables/information that outline which kits are needed for the corresponding part numbers/serial numbers are found in the GTC along with the detailed installation instructions. Information regarding which GTCs are incorporated on the gas generator that arrives at the contractor's facility is contained in the gas generator's logbook. Logbook service records shall be examined to determine the current Technical Directive Configuration, inspections, standard and mandatory configuration upgrades required.

All material required to complete the overhaul shall be identified in the Disassembly and Inspection Report (DIR), prior to the work scope meeting. The US Navy reserves the right to furnish replacement parts for unforeseen repairs. All remaining material required to complete the overhaul shall be procured by the contractor. The contractor shall only use parts identified in the LM2500 Illustrated Parts Breakdown S9234-AD-MMO-070 through S9234-AD-MMO-090/LM2500.

The contractor shall incorporate approved US Navy LM2500 Technical Directives listed in Table 2 of this document.

### **C.3.7 Technical Approval**

Deviations from the latest revisions of US Navy LM2500 depot level technical manuals, listed in Section C.2.2 of this document, such as waivers, engineering change proposals, material substitutions, engineering directives or alternate overhaul methods, not specifically stated in these manuals shall only be permitted after processing deviations and obtaining written approval from NSWC Code 9333. Documentation for requesting such deviations to the US Navy technical manuals shall be an email sent to NSWC Code 9333 followed by a letter on company letterhead.

All processes, procedures, inspection criteria, and components used in the overhaul of US Navy LM2500 SST gas generator shall be approved by NSWC Code 9333 for use or implementation in the gas generator overhaul. Approved procedures and components are listed in the US Navy LM2500 technical manuals, outlined in Section C.2.2 of this document. The Navy upon written request will evaluate additional procedures and components not listed in the aforementioned technical manuals on a case-by-case basis. Commercially equivalent procedures will be considered but are not approved for use without written authorization from NSWC Code 9333.

### **C.3.8 Receipt Reporting, Test, Disassemble, Inspect, Upgrade, DIR and Analyze the LM2500 SST Gas Generator NSN 2S 2835-01-237-1153**

The contractor shall store the LM2500 SST gas generator inside its nitrogen pressurized shipping container from the time of receipt of the asset up until the induction of the gas generator for overhaul. After the gas generator overhaul and operational testing is completed, the gas generator and service records shall be stored in the shipping container. At all times, before and after overhaul, when the gas generator is stored in the shipping container, the container shall be pressurized with nitrogen to preserve the components. Detailed instructions for the care of the US Navy gas turbine shipping container is outlined in the US Navy technical manuals S9234-AA-MMA-000/LM2500 Section 2-169 latest revision, and S9234-AB-MMD-030/LM2500 Chapter 14 latest revision.

If the shipping container is unable to hold the nitrogen charge when the container is received, or at any other time when the gas generator is stored in the shipping container, the contractor shall notify NSWC Code 9333 within two (2) working days.

Within five (5) working days after receipt of the US Navy LM2500 SST gas generator, the contractor shall contact NSWC Code 9333, to provide the serial number of the gas generator, and physical condition of the shipping container.

Within five (5) working days of container opening and receipt inspection of the US Navy LM2500 SST gas generator, the repair activity shall contact NSWC Code 9333 to report all parts/components that are missing, damaged or cannibalized.

The contractor shall disassemble, as necessary, to incorporate mandatory TDs, comply with LM2500 SST gas generator Minimum Work Scope requirements as defined in Sections C.3.5 through C.3.6 and maintain integrity of standard configuration.

Inspection is necessary to determine the extent of failures requiring repairs, conduct metallurgical evaluations and provide a DIR. The analysis shall result in a DIR on all SST gas generator's and concurrent parts, assemblies, or selected component items that are inducted for processing.

All inspection criterion, procedures, and modifications shall be in accordance with Sections C.3.4.1, C.3.5 through C.3.6 and subsequently supplemented utilizing the US Navy LM2500 depot level technical manuals outlined in Section C.2.2, and replacement parts in accordance with the LM2500 Illustrated Parts Breakdown S9234-AD-MMO-070 through S9234-AD-MMO-090/LM2500. Only parts listed in the Illustrated Parts Breakdown shall be used in the overhaul of US Navy LM2500 SST gas generator.

In those cases where specifications permit and it is economically feasible to do so, component parts of the gas generator shall be overhauled. "Economically Repairable End Items" are defined as end items which can be restored to a serviceable condition in accordance with the applicable requirements, and when costs of the overhaul will not exceed 75% of the US Navy stock list price specified in the contract. Whenever the contractor estimates that the total cost of overhaul of any end item received for overhaul and/or repair will exceed this limit, the contractor shall, in writing, promptly notify NSWC Code 9333 to that effect and shall not perform any further services on any such items except at the direction of NSWC Code 9333. Upon receipt by the contractor of a written determination by NSWC Code 9333 that a particular item cannot be overhauled, the contractor, at no additional cost to the US Navy, shall return the component to NSWC.

### C.3.9 Delivery

The US Navy LM2500 SST gas generator shall be overhauled, tested, documented and prepared for shipment within 125 days after induction into repair cycle. The contractor shall report work stoppage due to US Navy related delays to NSWC Code 9333 and to NSWC Code 3352, within three (3) working days. The repair cycle starts when the US Navy gas generator arrives at the contractor's facility, and is completed once the US Navy borescope inspection is performed after the acceptance test run. The Contractor shall arrange transportation of the gas generator so that the repair cycle will start within 30 days of award of contract.

### C.3.10 Engineering Change Proposals

The contractor shall incorporate approved class I Engineering Change Proposals (ECP) into items overhauled under orders under this contract if: the approved ECP states that the change is to be incorporated into the gas generator upon return to the depot and the part(s) necessary for incorporation are available; or the approved ECP replaces a part or parts with another part or parts without retrofit recommendation, and the older part(s) is (are) no longer available as government furnished equipment or contractor furnished equipment. An ECP is considered approved if block 24A of the appropriate DD Form 1692 is checked and block 24C has been signed.

A list of currently approved US Navy LM2500 ECPs is found in Table 3.

Approved ECPs/TDs promulgate modifications to improve equipment reliability and/or maintainability. The approved ECPs/TDs generate configuration changes which may add or delete parts or components. An Engineering Change Proposal – Allowance Parts List (ECP-APL) Number is provided to reflect the revised supporting parts. The TD and ECP-APL Numbers are used to track the Scheduling and accomplishments of the changes as applicable to various equipment, systems or ship. The ECP-APL Number is necessary for Configuration Status Accounting (CSA) even though the specific change may not involve a parts change; in these cases the head data for such ECP-APL will indicate that no parts are involved.

| ECP Number | TD Cross Reference | Title   |
|------------|--------------------|---|
| N-324      | -                  | LM2500 Commonality Changes:10.1 # 7R/7B Lube Nozzle, 10.2 #4R Heat Shield & B Sump Insulation Blankets                                      |
| N-295      | -                  | Introduction of One Half Size Shroud Support (C-Clip)   |
| N-272      | -                  | LM2500 "A" Sump/Inlet Gearbox Modification for Prevention of Lube Oil Leakage   |
| N-245      | -                  | Rear Compressor Stator Vane Locking Key Improvement - Increased Bearing Area, and Improved Outlet Guide Vane Design in Area of Locking Keys |
| N-238      | -                  | Forward Compressor Stator Vane Locking Key Improvement - Increased Bearing Area.  |

**Table 3: Approved LM2500 ECPs****C.3.11 MGTE Logbook**

The contractor shall maintain the concurrency of the logbook received with the gas generator in accordance with the latest revision of NAVSEA technical manual (S9086-HC-STM-000/Chapter 234, Section 8), for the Marine Gas Turbine Equipment (MGTE) service records received with the equipment.

The document shall be reviewed to ensure that the extent of accomplished overhaul/inspection has been accurately logged in the appropriate logbook record forms and compiled prior to packaging the equipment for shipment. The contractor shall notify NSWC Code 9333 if the MGTE logbook received from the government is erroneous or is not current. The MGTE logbook shall be enclosed in a transparent, waterproof/greaseproof bag (with a reusable, press fit, zip type or equivalent closure) prior to packaging and enclosed with the SST gas generator prior to shipment. The contractor shall notify NSWC Code 9333 if the MGTE logbook is not received with the equipment.

**C.3.12 Gas Generator DIR and Overhaul Report**

Disassembly and Inspection Reports (DIR): Is the engineering analysis of the removed parts, assemblies, or components to determine the cause(s) or the symptoms which precipitate removal and of other conditions not meeting acceptance criteria. The analysis shall result in a DIR on the SST gas generator and concurrent parts, assemblies, or selected component items that are identified for induction and processing. The format of a DIR report is provided in CDRL A003 of this contract. The DIR report shall be submitted within forty-five (45) days after SST gas generator induction.

The contractor shall compile a gas generator overhaul report in the contractor's format. This report shall be submitted to NSWC Code 9333 within sixty (60) days after completion of overhaul, in accordance with Contract Data Requirement (DD 1423). This report at a minimum shall contain:

- a. All incoming inspection results with teardown inspection records.
- b. All inspection data and damage reports.
- c. Total overhaul work scope, including the logbook record of overhaul.
- d. A list of all parts replaced and/or upgraded (e.g. part numbers, serial numbers and work performed).
- e. Pictures of damage found.
- f. Assembly records, a detailed step-by-step record of gas generator assembly.
- g. Test records from all testing performed (including accessories).
- h. Borescope inspection report (for the borescope that is performed by the contractor).
- i. List of all technical directives, and industrial service bulletins incorporated during gas generator overhaul.
- j. All authorized deviations from US Navy LM2500 depot level technical manuals.
- k. Method of shipment and location shipped to.
- l. Data elements of DIR not listed in this report.

The repair activity shall submit DIR and Overhaul reports related to MGT condition recorded during induction, recommendations, all parts replaced, and actions taken during repair.

**C.4 Testing Requirements****C.4.1 General**

After overhaul and assembly, the contractor shall test the US Navy LM2500 SST gas generator assembly in accordance with the testing and the acceptance/rejection criteria cited in the latest revision of the appropriate US Navy LM2500 depot level technical manuals. The gas generator shall be tested to ensure that it will operate properly

when installed shipboard. US Navy LM2500 SST gas generator shall be tested in accordance with the testing procedures outlined in Chapter 13 of the US Navy LM2500 technical manual S9234-AB-MMD-030/LM2500 latest revision. The gas generator shall be tested and performance data corrected to the standard US Navy day, ambient temperature of 100 degrees Fahrenheit and ambient pressure of 14.7 psia. The overhauled gas generator performance data, after corrected to a 100 degree Fahrenheit day, shall meet or exceed the criteria stated in the testing section of the US Navy LM2500 depot level technical manual.

The overhauled gas generator would be expected to operate within the following performance guidelines when compared to a nominal new engine baseline as defined in the LM2500 NARF performance reduction program when performance data is corrected to the standard US Navy day, ambient temperature of 100 degrees Fahrenheit and ambient pressure of 14.7 psia, and operated at full power:

- a. Does not exceed the “as installed” shipboard T5.4 limit of 1575 degrees Fahrenheit.
- b. Liquid fuel flow by no more than 1% below the baseline.
- c. Compressor efficiency by no more than 1.2% below the baseline.

The contractor shall notify NSWC Code 9333 fourteen (14) days prior to any gas generator testing, in order for a Government representative to be present during the testing. Data from any and all testing will be enclosed in the gas generator overhaul report produced by the contractor.

## **C.5 Quality Assurance**

### **C.5.1 General**

The offeror shall provide a commercial warranty, which applies to the overhaul work performed under the contract to cover the overhaul performed under the contract.

The contractor shall maintain an internal component tracking system within their facility.

The contractor shall minimize the use of subcontractors for overhaul of major components (i.e. compressor assemblies, TMF assemblies, etc.).

The contractor shall allow for the gas generator to have a borescope inspection performed by US Navy personnel at the contractor’s facility after the acceptance test is run. The gas generator shall meet or exceed all US Navy standards before acceptance. Any components that are deemed unsatisfactory by the US Navy inspectors shall be replaced before the US Navy accepts the gas generator. The rejection of components and/or the classification of unsatisfactory will be in accordance with the criteria specified in the US Navy technical manuals listed in Section C.2.2 of this document. Components that are deemed unsatisfactory shall be replaced at no additional cost to the US Navy.

At the time of the acceptance test and subsequent borescope inspection, the gas generator shall be cleaned in accordance with procedures outlined in US Navy LM2500 depot level technical manual S9234-AB-MMD-010/LM2500 Chapter 3 or US Navy approved equivalent standard commercial procedures.

## **C.6 Packaging and Shipping**

The contractor shall be responsible for all shipping required to overhaul the US Navy LM2500 SST gas generator. The contractor shall have the LM2500 SST gas generator shipped from Philadelphia, PA to the contractor’s facility. When the overhaul is complete and the contractor is ready to ship the overhauled US Navy LM2500 SST gas generator, the asset shall be stored and shipped in accordance with procedures outlined in the technical manuals cited below. The contractor shall ship the gas generator to NSWCCD-SSSES (address provided in Section F). The US Navy gas turbine shall be stored in US Navy provided reusable LM2500 shipping container. The US Navy requires that if the US Navy LM2500 SST gas generator is in storage before the asset is shipped back to a US Navy facility, the asset shall be stored in a nitrogen pressurized US Navy shipping container, as specified in Section C.3.8 of this document.

The gas generator shall only be shipped in the US Navy provided LM2500 gas generator shipping container. Shipping shall be in a manner such that the input loads to the container do not exceed 34.335 meters per second per second upward, 24.525 meters per second per second downward, 14.715 meters per second per second lateral, and 19.62 meters per second per second fore and aft. Shipment via highway or rail, require the utilization of a pneumatic suspension trailer or pneumatic suspension rail car.

The container shall be inspected in accordance with technical manuals S9234-AA-MMA-000/LM2500 Section 2-169 latest revision, S9234-AB-MMD-030/LM2500 Chapter 14 latest revision. The overhaul of the container is not specifically part of this contract. If the container is deemed to be in need of overhaul the contractor shall contact NSWC Code 9333 upon receipt of the container. It should be noted that this is a reusable and repairable container. At no time shall the LM2500 gas generator shipping container be disposed of.

In the event that the gas generator is in storage either prior or post overhaul, storage maintenance shall be performed on the gas generator in the shipping container, to ensure container nitrogen preservation pressure charge and desiccant is not compromised. This maintenance shall be performed on a monthly basis.

## **C.7 Proposal Requirements**

### **C.7.1 Overhaul Report**

The offeror shall submit, with their technical proposal, one (1) gas generator overhaul report, generated since 2001, for other LM2500 gas generator customers that addresses the contractor's ability to perform overhaul work of the LM2500 in accordance with the minimum work scope requirement identified Section C.3.5.1 through C.3.6 of this specification. Report should include turn around time.

### **C.7.2 Test Cell Operational Report**

The offeror shall submit, in their testing proposal, one (1) test cell operational report, generated since 2001, for other marine or industrial LM2500 gas generator customers. Test cell performance data shall be submitted to confirm the requirement for prior experience with the overhaul of the General Electric LM2500 SST gas generator for industrial or marine customers. The report shall be generated by the test facility that is owned by the offeror and shall be the same facility that will be used to test the US Navy gas generator. Testing of the US Navy LM2500 SST gas generator shall not be subcontracted without written approval from NSWC Code 9333.

### **C.7.3 Test Cell Information**

The contractor shall provide documentation to state whether or not the US Navy LM2500 gas generator will be tested with slave accessories.

### **C.7.4 Facility Audit**

The US Navy reserves the right to conduct a facility audit on offerors found to be technically acceptable. If an audit is conducted, the following will be viewed by the Government evaluation team: LM2500 SST gas generator special support equipment and tooling, machinery required to perform an overhaul of a LM2500 SST gas generator, inspection of the internal component tracking system, the LM2500 test cell, evaluation and/or verification of the capability of meeting the upper gas generator repair requirement, bonded material evaluation, amount of US Navy approved material in stock storage facility evaluation, and maintenance plan for inspecting and preservation of the US Navy gas generator in storage.

### **C.7.5 Component Tracking System**

The offeror shall submit with their facility capacity proposal documentation on their in house internal component tracking system for evaluation.

**C.7.6 Accessory Overhaul Report**

The offeror shall submit, with their facility capacity proposal, one (1) accessory overhaul report for each of the LM2500 accessories (main fuel control, starter, power lever angle actuator and lube oil pump) overhauled by the offerors facility and generated since 2001, for other LM2500 gas generator customers. These reports shall addresses the contractor's ability to perform LM2500 accessory overhaul work in accordance with the minimum work scope requirement identified Section C.3.5.1 through C.3.6 of this specification.

**C.7.7 Subcontracting**

The offeror shall submit, with their technical proposal, a list of all subcontractors they plan to utilize during performance of the contract and list which component(s) the subcontractor will be overhauling.

## SECTION D Packaging and Marking

Packaging shall be in accordance with Section C.6 of the Statement of Work.